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STUDIES OF THE WHISTLING SWAN, 1967-1968[1]

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Over one half of North America's whistling swans (*Cygnus columbianus columbianus*) spend their winter on the estuaries of the Chesapeake Bay and Currituck Sound in Maryland, Virginia, and North Carolina. Winter counts indicate that they are increasing; the estimate in January, 1967, from the Chesapeake Bay alone was over 52,000 birds. The Pacific population winters in small numbers in British Columbia, but mostly in Utah and in the Sacramento Valley, California (Sherwood, 1960).

The whistling swan has been carefully protected for over 70 years. It breeds in the high arctic tundra where man has little influence on its environment. However, over part of its migration route and in its winter quarters it comes into close contact with man.

The population that winters along the Atlantic coast passes through areas, such as Lake Erie, that are highly polluted. Its sojourn in the Chesapeake Bay brings it alongside one of the most rapidly expanding human populations in eastern U.S.A. Very little is as yet known about the speed, or even the routes, of migration across the U.S.A. and Canada to and from their arctic breeding grounds, but they do pass over heavily congested areas of human populations and cross important airline routes. Since the loss of the Viscount airliner in Maryland in 1962 as a result of a collision with swans, there has been a growing awareness of the potential hazard of these swans and other large waterfowl to aircraft.

The Air Force Office of Scientific Research (1966) stresses the need for biological studies of bird movements, as related to migration, nesting, and feeding, as a vital aid to solving the problems of bird/aircraft collisions. The Canadian Wildlife Service suggests certain simple modifications of habitat around airports to make them less attractive to birds (Solman, 1968). We are anxious to find out how we can live in harmony with these bird populations and yet protect ourselves without harming them. With this in mind a program was started in February, 1967, at the instigation of the Canadian Wildlife Service, to study the local and migratory movements of the whistling swan and to gain further understanding of how this magnificent bird fits into the estuarine ecosystem as suggested by Stewart and Manning

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[1]Contribution No. 1 of the Chesapeake Bay Center for Field Biology.
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(1958). The headquarters of our operation on the Western Shore of the Bay is the Chesapeake Bay Center for Field Biology[3] between the Rhode and West Rivers south of Annapolis, Maryland. Much of our activities are also on the Eastern Shore between Eastern Neck Island and St. Michaels where some of the largest concentrations of swans spend the winter.

METHODS OF STUDY

(i) *Capture.* During the two winters, 1967-1969, a total of 178 swans were captured: 105 by funnel trap, 17 by cannon net, 53 by drugs, and 3 by miscellaneous methods. The most satisfactory method was the funnel trap, but it could not be used when the Bay froze. The drug method, using a combination of a tranquilizer, Diazepam,[4] mixed in bait with an anaesthetic, alpha-Chloralose (Crider *et al.*, in press) shows great promise for catching large numbers at a time, but it needs further carefully controlled experiments. In their breeding grounds in the Yukon-Kuskokwim Delta (Clarence Rhode National Wildlife Refuge), Alaska, 179 swans were banded by aid of float plane in August, 1968. At the same time Tom Barry (personal communication) of the Canadian Wildlife Service has banded several hundred whistling swans in the Mackenzie and Anderson River deltas, Northwest Territories, Canada. Small numbers have been caught at Bear River National Wildlife Refuge, Utah, and at Shiawassee National Wildlife Refuge, Michigan.

(ii) *Bands.* Conventional U.S. Fish & Wildlife (FWS) aluminum bands are being used following a protocol established internationally in Antarctica (Sladen *et al.*, 1968) using the left tarsus to indicate birds of known age (*i.e.* banded as cygnets, or in their first winter when the plumage is characteristically grey), and right tarsus for adult-plumaged birds of unknown age. On the opposite tarsus is being placed a conspicuous 1.5 inch (38 mm) tall plastic color band (*white* for Maryland and Virginia; *red* for arctic Canada, and *blue* for Alaska) with 3 large, 7/16 inch (11 mm) numbers and a letter prefix (e.g. *C102*) reading upwards and repeated 5 times around the band. These color bands (Fig 1), with no address, are modified from a design used by Peter Scott, Wildfowl Trust, on Bewick's swans (*Cygnus columbianus bewickii*) in Britain and can be read with field glasses or spotting scope from any position when the swan is standing, upending or swimming away rapidly. It enables us to instantly identify (by the color) the area where banded, and to recognize the bird as an individual (from the reference number)

[3] A collaborative program between the Smithsonian Institution, University of Maryland, and the Johns Hopkins University.
[4] Trained of Hoffman LaRoche, N.J.

Figure 1.—Color bands are modified from bands used on swans in Britain designed by Peter Scott Wildfowl Trust. Color bands are blue with prefix A for Alaska banded swans; red with prefix B for arctic Canada, and white with prefix C for birds banded in Maryland and Virginia.

without further recapture. We attach great importance to the placing of permanent and *individual*-identifying and easily read bands on these *birds for future studies on behavior and movements.*

(iii) *Dyeing.* Our program is using different combinations of yellow (picric acid) and black or purple (nyanzol) dyes for conspicuous identification in the field. The patterns for the Chesapeake Bay birds (yellow) are such that 4 different local populations can be readily identified. All birds banded at Back Bay, Virginia, are being dyed black. The winter populations are characterized by dye covering the lower half of the neck as well as varying parts of the back and wings; the populations handled in the arctic breeding grounds by dye covering the upper half of the neck only (arctic Canada—yellow; Alaska—black). The birds processed in Maryland and Virginia are held overnight to allow the dye to dry, but this is impossible on the arctic tundra; thus, the dye pattern for the arctic is confined to the top half of the neck, as far away from the water as possible.

A limited number of easily recognized combinations of yellow and black dye on the neck are being used to individually recognize swans carrying telemetry transmitters (see below). These consist of bands of *black on the neck dyed yellow, of bands of yellow or of* black dye on the undyed white neck. Each of these color combinations can provide 9 easily recognized patterns, so a total of 27 birds carrying transmitters can be recognized conspicuously as individuals.

The dyes do not harm the birds, nor do they appear to affect their winter behavior or family patterns. When the birds molt during the summer the dye is lost, so birds dyed during the winter will regain normal plumage within 5 to 8 months. All dyed birds are metal and color-banded, so subsequent observations are still possible without recapture.

(iv) *Radar tracking.* We consider the dye techniques essentially as a preliminary to more sophisticated methods such as radar and biotelemetry. The swan is proving an ideal subject for radar interpretation, for it migrates in large parties at fairly predictable times of the

day, thus producing large echoes on the screen. Speed of flight may also help to differentiate swans from other large birds. We are correlating observations made on the ground with those recorded on radar films and attempting to positively identify swans. These studies are being coordinated by William Gunn of the Canadian Wildlife Service and will be reported by him elsewhere.

(v) *Biotelemetry.* Radar and dyeing are providing data on mass movements and general directions of migrating swans. Biotelemetry is providing data on individual birds. In March, 1968, eight swans were harnessed with transmitters[4] weighing about 90 grams. Portable receiving equipment was used in a truck and an airplane. Ranges obtained from the truck to swans on the water varied from 1½ to 8 miles, the longer ranges being obtained when the truck was at higher elevations. For low-flying swans ranges up to about 15 miles were common, and when the swans flew high (500 feet and up) ranges were 25 to 30 miles. From an airplane ranges of 25 miles were typical.

Swans dyed prior to their spring migration have provided a spectacular number of sight records from five states (Pennsylvania, New York, Michigan, Wisconsin and N. Dakota) and in Canada from ters and harness became covered with feathers, only the whip antenna and occasionally the back of the transmitter were visible.

RESULTS

So far we can report 4 birds that were originally banded in the Chesapeake Bay recaptured, 2 in precisely the same trap location, and 2 within 4 miles of it, after one visit to the arctic. Swans dyed on the Eastern Shore of the Bay have been sighted on the Western Shore 10 miles from their original site of capture and Western Shore birds have been seen on the Eastern Shore up to 13 miles away. These sightings have all been prior to migrations as have the ones recorded from birds carrying transmitters (Fig. 2).

Swans dyed prior to their spring migration have provided a spectacular number of sight records from five states (Pennsylvania, New York, Michigan, Wisconsin and N. Dakota) and in Canada from Ontario, Manitoba, Saskatchewan and Northwest Territories. The yellow dye, has proved by far the most effective color for sight records. Of only 15 dyed this color in March, 1968, three were seen resting with several thousand swans on the Susquehanna flats, at the northern end of the Chesapeake Bay, on their way north on March 21, two of them together as paired birds. Four months later, and in their tundra breeding grounds some 3,000 miles away, 3 were also reported by Tom Barry (personal communication) and his colleagues in the

[4]Made by AVM Instrument Company, Champaign, Illinois.

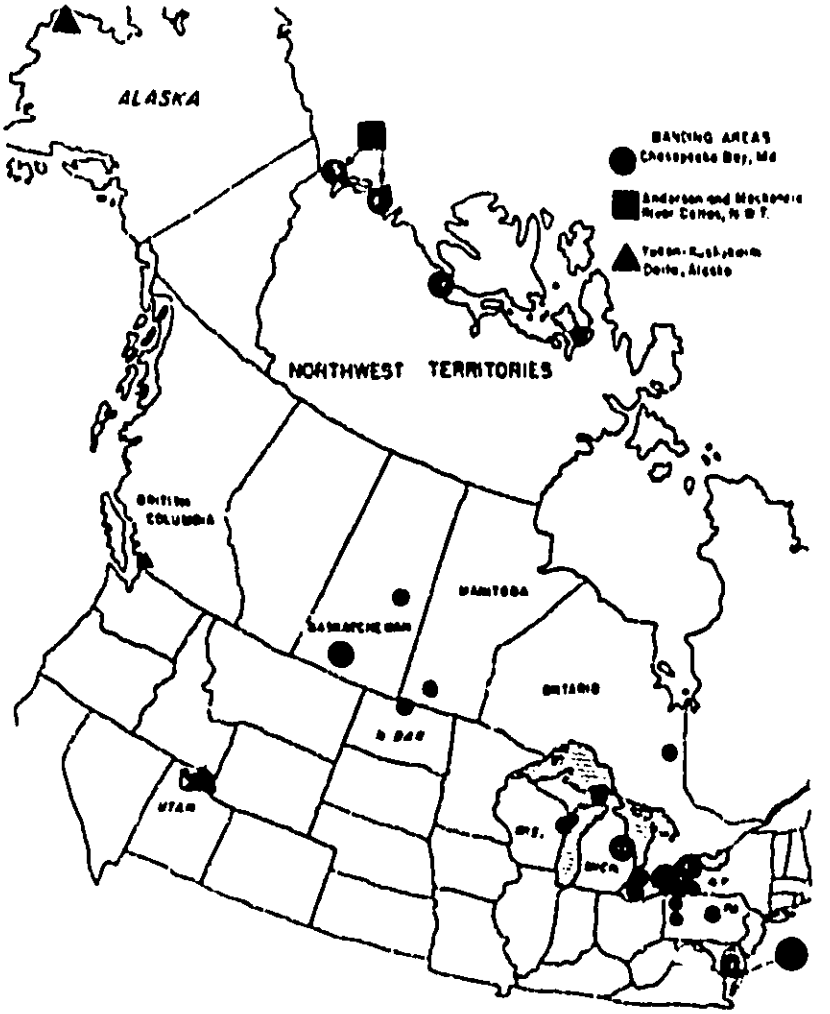

Figure 2 -- Sightings or recoveries of dyed and/or color banded Whistling Swans, 1961-1964. The California recoveries are not included.

Mackenzie and Anderson River deltas, N.W.T. Two of these yellow-dyed swans were side by side and believed nesting. This remarkable sighting-rate of 3 out of 15 (20%) in their breeding grounds demonstrates what excellent study subjects these swans are and how dyeing can be effectively used to define the breeding areas. Figure 2 summarizes the sightings or recoveries so far of dyed and/or color-banded whistling swans and demonstrates that birds marked in the

Chesapeake Bay are breeding along the tundra from the Mackenzie River delta (4 sightings) eastwards to the Anderson River delta (3), Coppermine River (2), and King William Island, Northwest Territories. Only five recoveries have been reported so far from 179 banded (but not dyed) in Alaska in August, 1968. One was found dead in December near Victoria, British Columbia; two were shot in Utah during the November hunting season in Farmington Bay and Bear River National Wildlife Refuge, and two others on November 28 near Sierraville, California.

Results from the 8 birds carrying small transmitters have added further information on local and migratory movements. Swans #1 and #2 were caught at Sherwood Forest on the Severn River north of Annapolis, the others near Claiborne in Eastern Bay. They were all released at Hackett Point at the western end of the Chesapeake Bay Bridge 7 and 14 miles respectively from their sites of capture. Hackett Point is an important pre-migration staging area and for this reason was used as our main tracking station in 1968.

The movements of swan #1 (adult plumage, female) for 10 days after release on March 18 were in the same area and consisted of swimming and feeding with other swans and of occasional short flights. During the next 8 days numerous 7 to 8 mile flights were made between the release area and the trapping area (Figure 3). During the 18 days of observations it was occasionally seen alone, but was usually with 3 to 12 other birds. On April 5 it left Hackett Point, presumably on migration. The flight was north over Baltimore, and the swan outdistanced the truck, which was hampered by evening rush-hour traffic. On April 19, this bird was seen, in apparent good condition at Seney, Michigan.

Swan #3 (juvenile plumage, male), which was displaced 14 miles, flew 8 miles southeast towards its site of capture the day after release. Here, in Eastern Bay, it associated with a small group of other swans at a pre-migration staging area and made no further extensive movements until it migrated on March 31. When this bird took off the truck was northeast of the Baltimore traffic and thus it was followed as far as the Pennsylvania-Maryland border south of Harrisburg (Fig. 3). The average ground speed of swan #3 was 45 mph. It migrated north, carrying it just east of the Baltimore City line. On January 2, 1969, about a year later, this bird was picked up dying near Milford, Delaware. The transmitter and harness were still intact, the young bird presumably having carried it to the arctic and back again. There was a small bare area of thickened skin underneath the transmitter and the bird had only partially molted; otherwise no evidence of harm to the bird could be found. Autopsy revealed a

massive infection of heart worm (*Sarcocystis cruzi*), which was undoubtedly the cause of death and probably also of the partial molt. This heart infection has been reported as common in Chesapeake Bay whistling swans and other species of swan and geese (Holden and

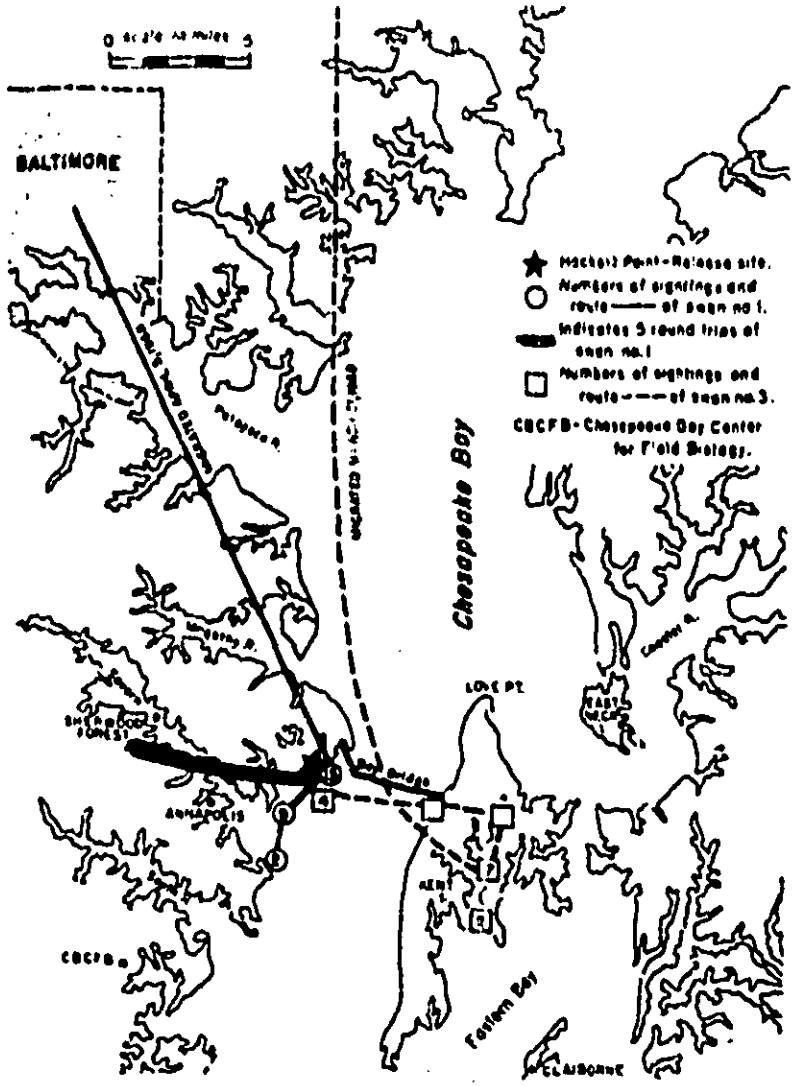

Figure 3.—The local and migratory movements of telemetry transmitter swans 21 and 23 from the Chesapeake Bay.

Sladen, 1968). It is therefore unlikely that the transmitter contributed to the death of the bird.

Further information was gathered on 2 of the remaining 6 swans carrying transmitters. Swan #4 (adult plumage, female) was found dead at Rock Hall about 14 miles northwest of Hackett Point; swan #9 (*adult plumage, female*) was *recaptured alive in good health on* March 8, 1969, at Chaisorne, Maryland, in the same area where originally captured one year earlier. It had undoubtedly travelled to and from the arctic and lost its transmitter in transit. Further telemetry studies are underway for 1969 and will be reported elsewhere.

DISCUSSION.

Preliminary studies of the whistling swan are showing that this bird could be an ideal model for migratory studies on waterfowl. Preliminary trials with biotelemetry have been able to precisely locate individual birds in their wintering area and track local premigratory movements. One bird was tracked for the first part of its migration from the Bay to Pennsylvania south of Harrisburg. This spring (March, 1969) we hope to track birds at least as far as Lake Erie, Ontario, and gain much-needed information on the number of landings and take-offs and altitude of flight.

Our studies of local movements indicate that the birds are reluctant fliers and when up rarely reach an altitude of 1,000 feet. However, when they take off on their migrations they rapidly attain a much greater altitude. They are certainly not infallible predictors of weather conditions ahead and can become confused, as was the case over Pennsylvania during the third week in March, 1968, when large numbers departed from the Chesapeake Bay under ideal conditions but encountered unfavorable weather as they flew northwest. Swans were reported circling State College, Pennsylvania, during the night in rain or fog and landing in fields or small ponds (Hansblokpoel, personal communication). Some reversed migration and returned to the Chesapeake Bay. These are the conditions we are interested in exploring further so we can better predict the possible hazards to aircraft. *There is no reason why we cannot live in harmony with these* birds and enjoy the spectacular sights of their winter concentrations so long as we can learn more about their biology and migrations.

ACKNOWLEDGMENTS

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DISCUSSION

DR. GORDON GUNTER (Gulf Coast Research Laboratory, Mississippi): Have you noticed any social ostracism of any kind of these dye-marked birds?

DR. SLADEN: Our yellow-marked birds and the white birds were fully integrated. Two yellow birds were seen side by side on the breeding grounds. In other words, they probably nested together.